

COST-G combination of Swarm gravity fields of different analysis centers

Ulrich Meyer, Christoph Dahle, Daniel Arnold, Adrian Jäggi

Astronomical Institute, University of Bern

Swarm Data Quality Workshop

Prague, Czech Republic

16 – 20 September, 2019

Content

- IAG Services
- COST-G
 - Products
 - Work Flow
- Combination of Swarm gravity fields
- Validation
- Product dissemination
- Application of Swarm gravity fields

Funded by **ESA** Swarm DISC contract SD-ITT-1.1,
part of contract 000109587/13/I-NB



Swarm Data Quality Workshop

Prague, 16 – 20 September, 2019

International Association of Geodesy

Int. Gravity
Field Service



Int. Gravimetric
Bureau



Int. Geoid Service



Int. Geodynamics and
Earth Tide Service



Int. Center for Global
Earth Models



Int. DEM Service

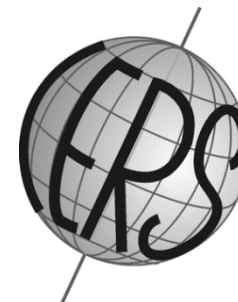


Permanent
Service for
Mean Sea Level



Combination Service for Time-variable Gravity Fields

Product Center of the IGFS



Int. Earth
Rotation
Service



IGS
INTERNATIONAL
GNSS SERVICE



Int. Laser
Ranging
Service




Int. VLBI
Service



Swarm Data Quality Workshop

Prague, 16 – 20 September, 2019

COST-G: Products



Combination Service for Time-variable Gravity Fields

Home Introduction Consortium Service **Products** Documents Contact The COST-G Plotter

Products

COST-G provides a number of products via different platforms and channels:

GRACE

Level 2 – Products are sets of spherical harmonic coefficients which stem from the combination on solution or normal equation level. The coefficients need to be processed by a spherical harmonic synthesis in order to derive gridded data. They are available at the International Center for Global Gravity Earth Models (ICGEM): http://icgem.gfz-potsdam.de/series/03_COST-G/GRACE

Level 2b – Products will be available soon.

Level 3 – Products will be available soon.

GRACE Follow-On

Level 2 – Products will be available soon.

Level 2b – Products will be available soon.

Level 3 – Products will be available soon.

Swarm

Level 2 – products are a combination of different kinematic orbit products and various gravity field recovery approaches. Data is available at the International Center for Global Gravity Earth Model (ICGEM): http://icgem.gfz-potsdam.de/series/03_COST-G/Swarm

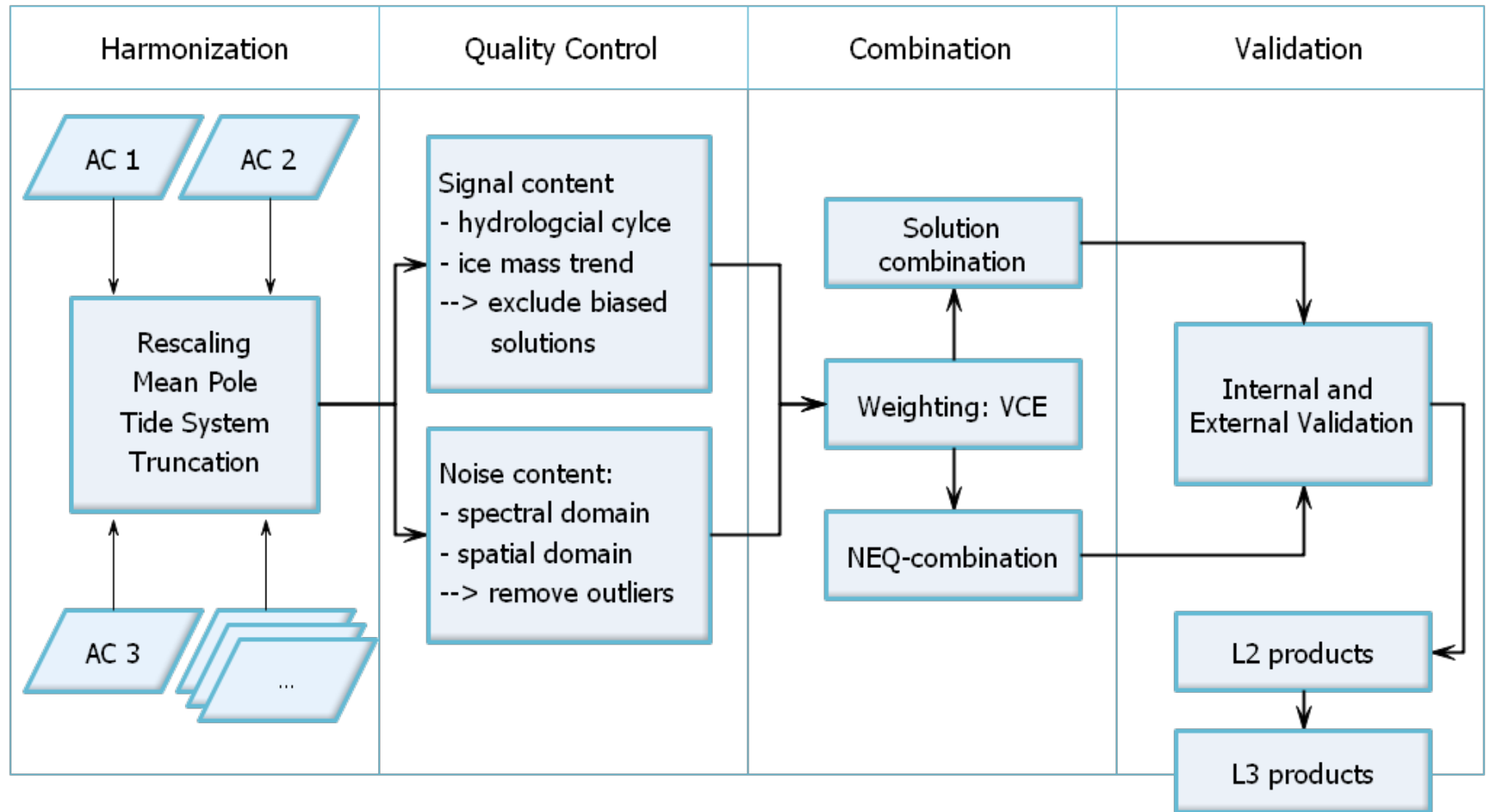


Swarm Data Quality Workshop

Prague, 16 – 20 September, 2019

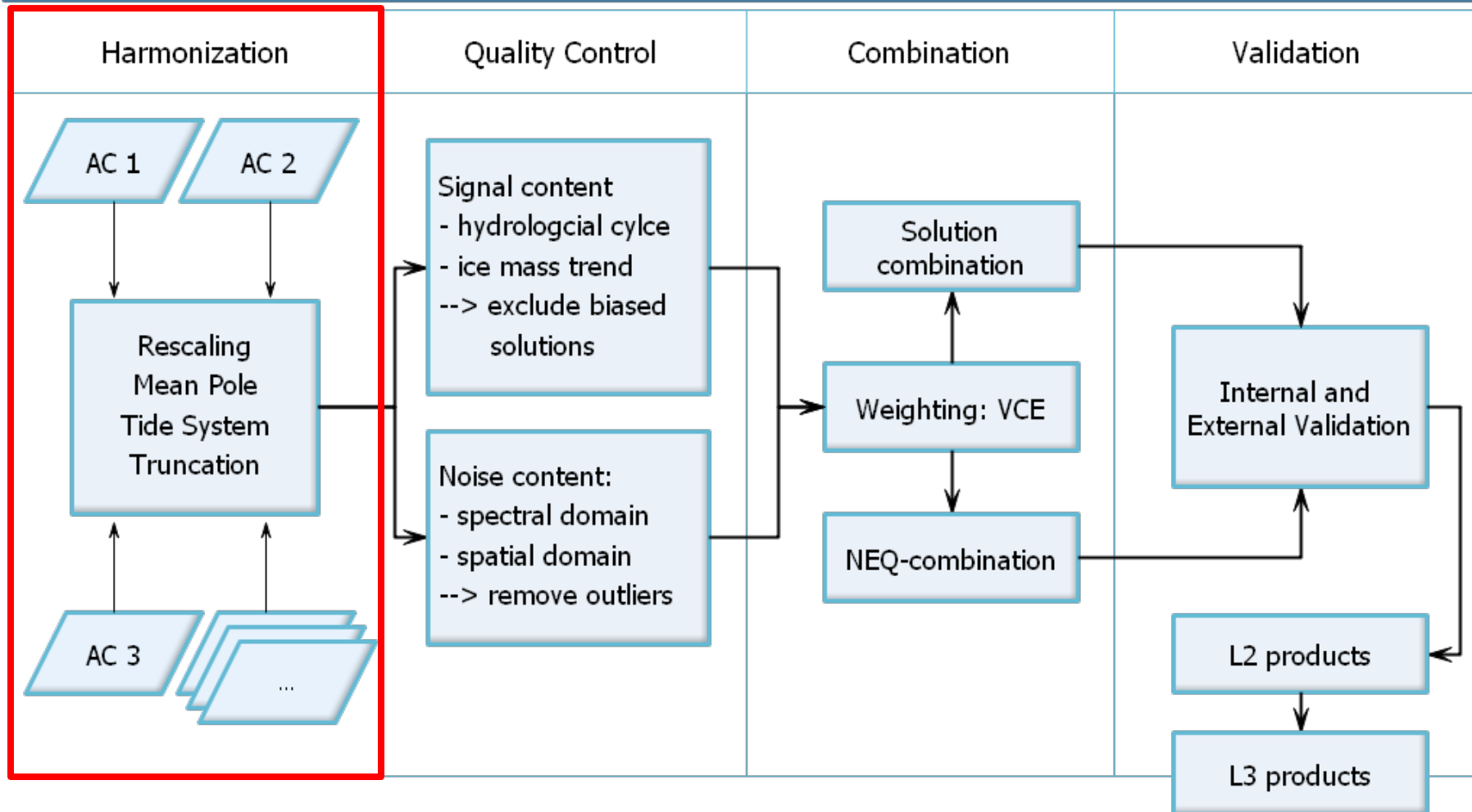
COST-G: Workflow

Combination Process



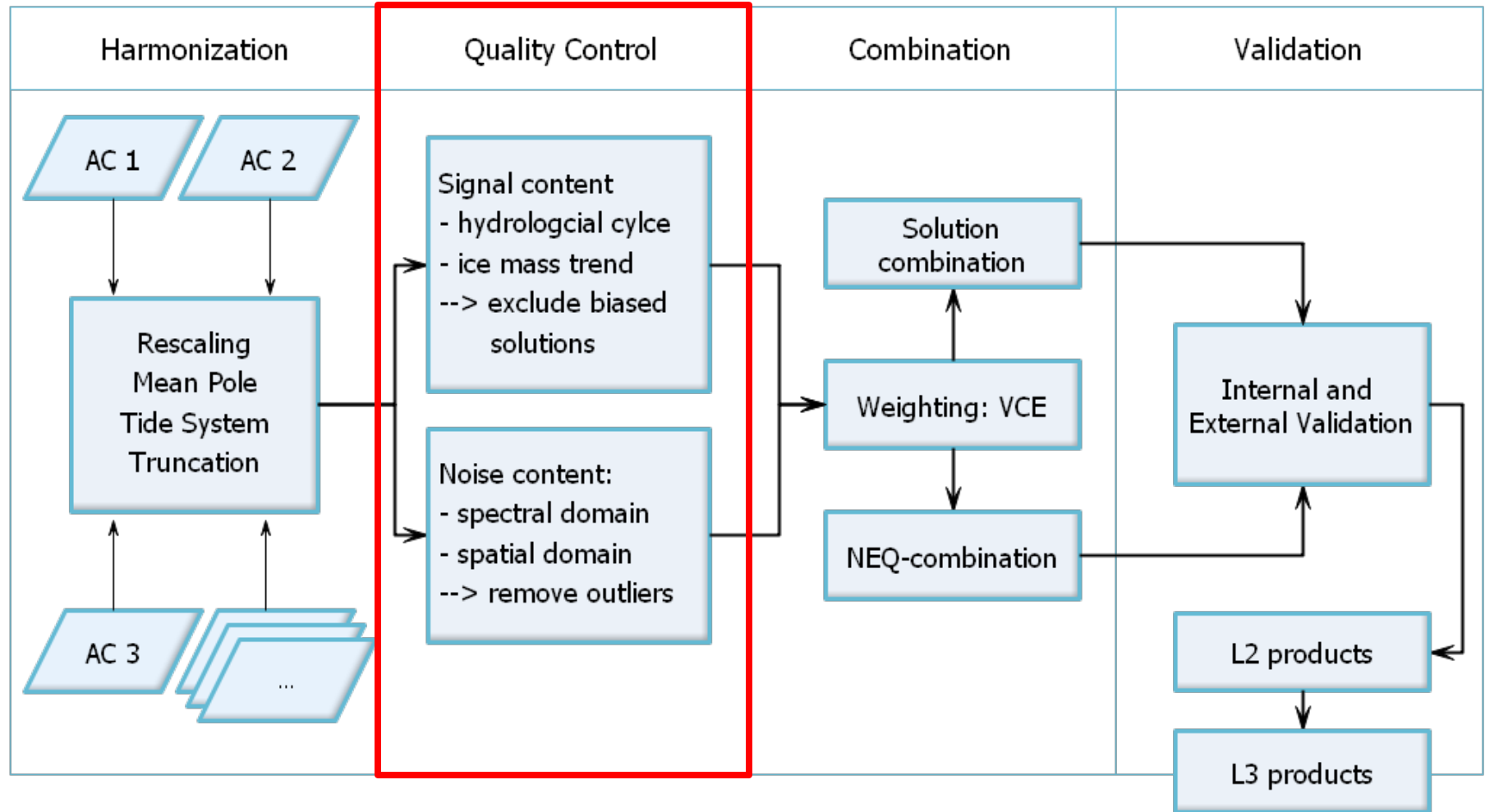
COST-G: Harmonization

Combination Process



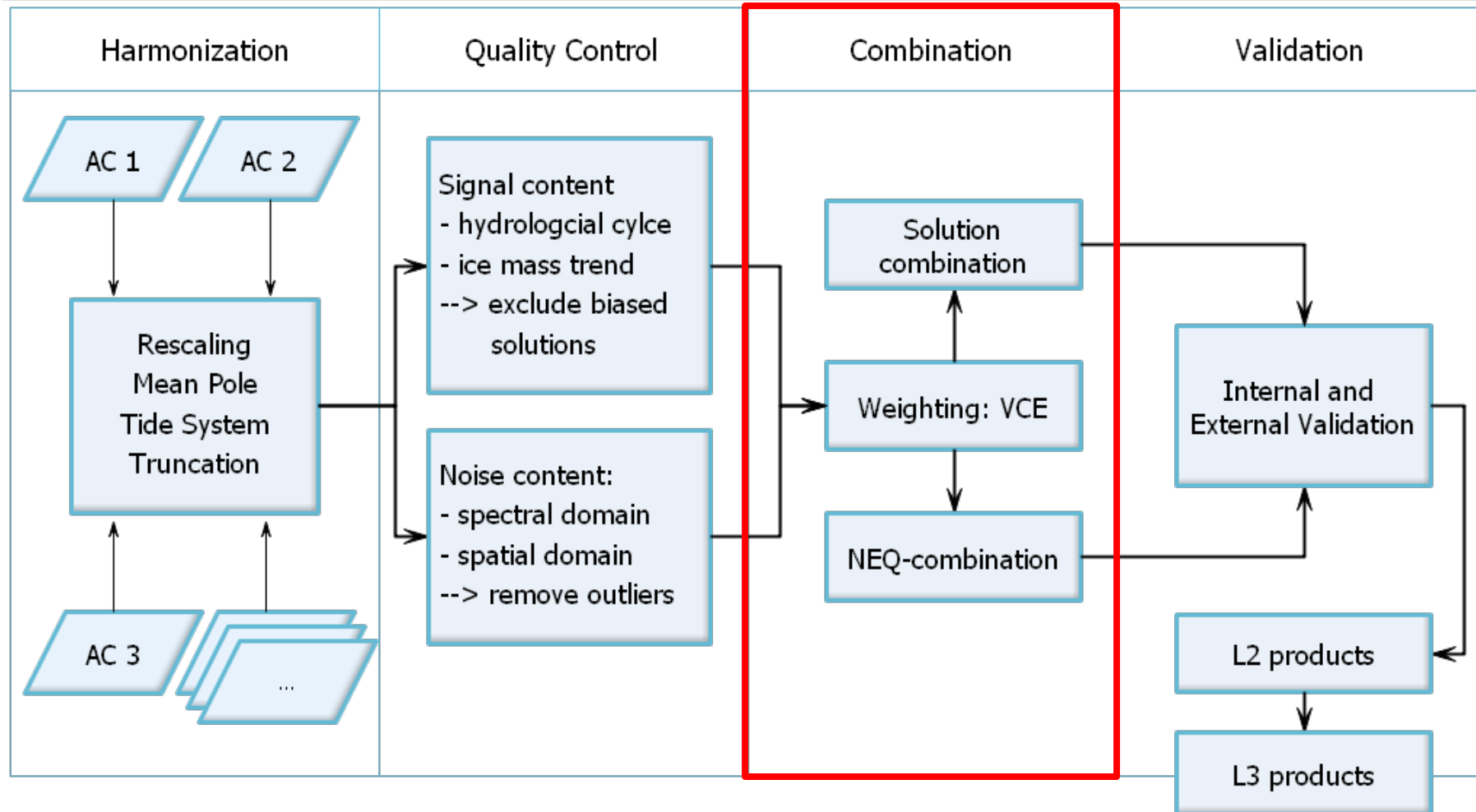
COST-G: Quality Control

Combination Process

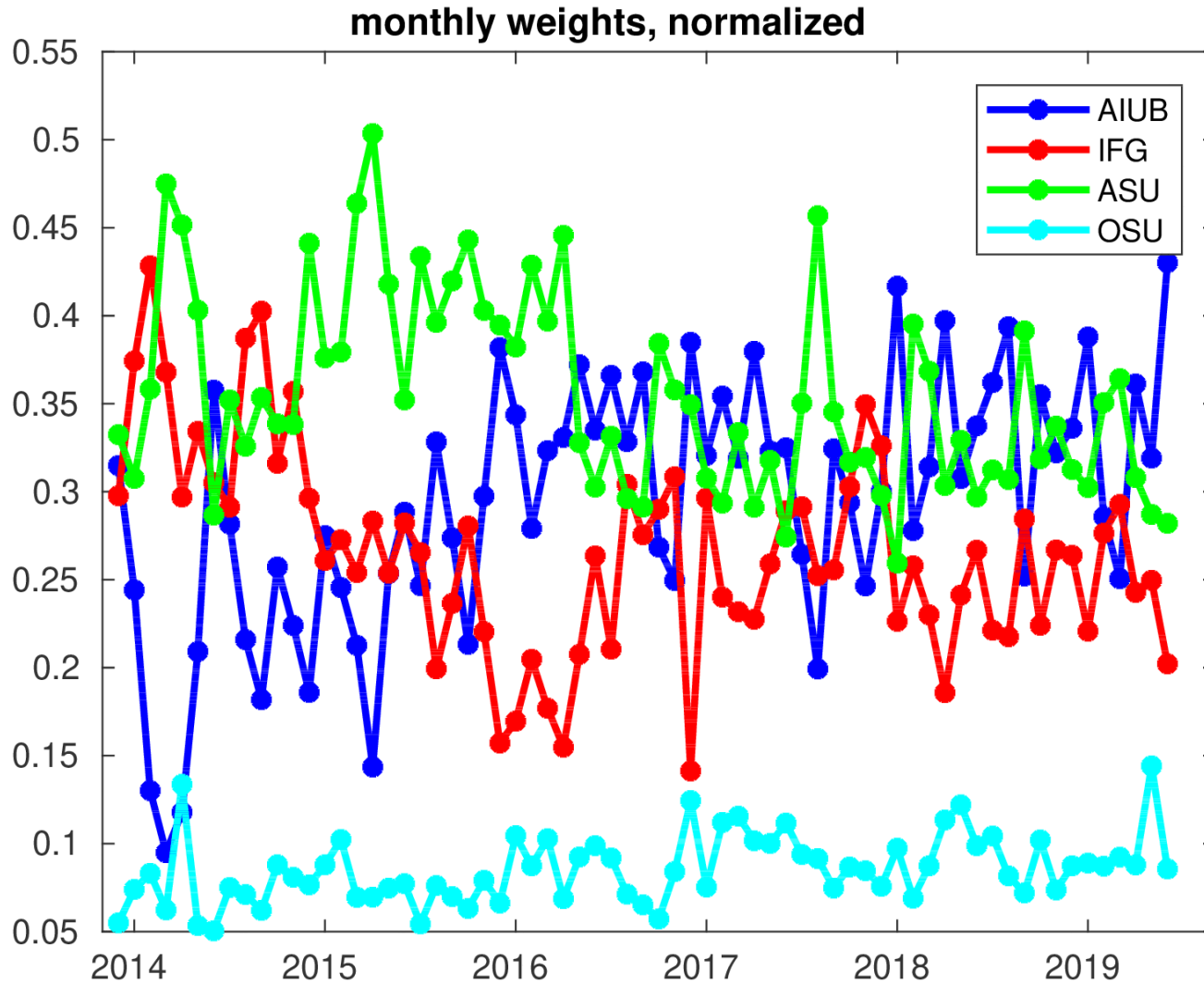


COST-G: Combination

Combination Process

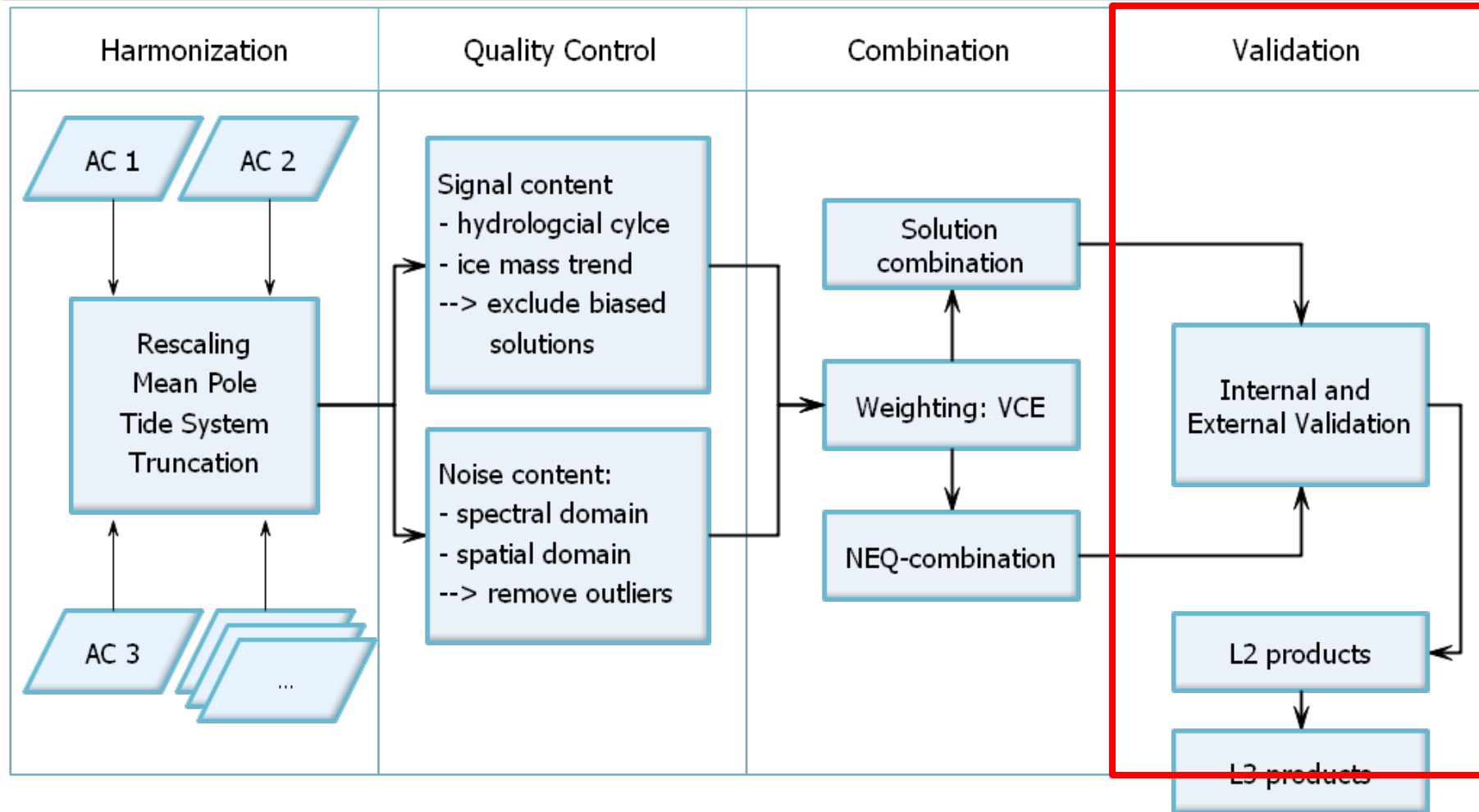


Variance Component Estimation

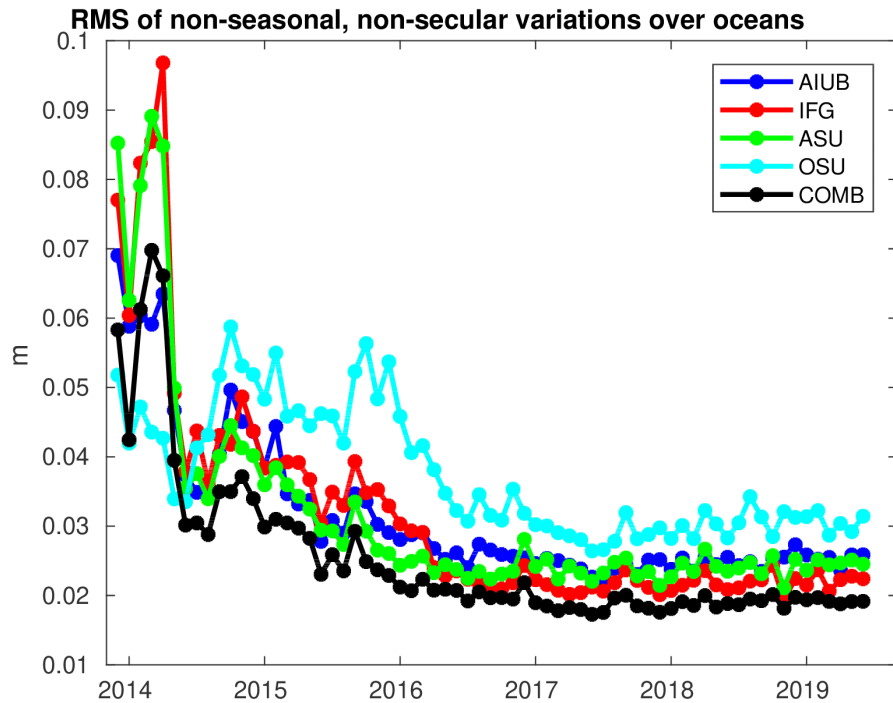


COST-G: Validation

Combination Process

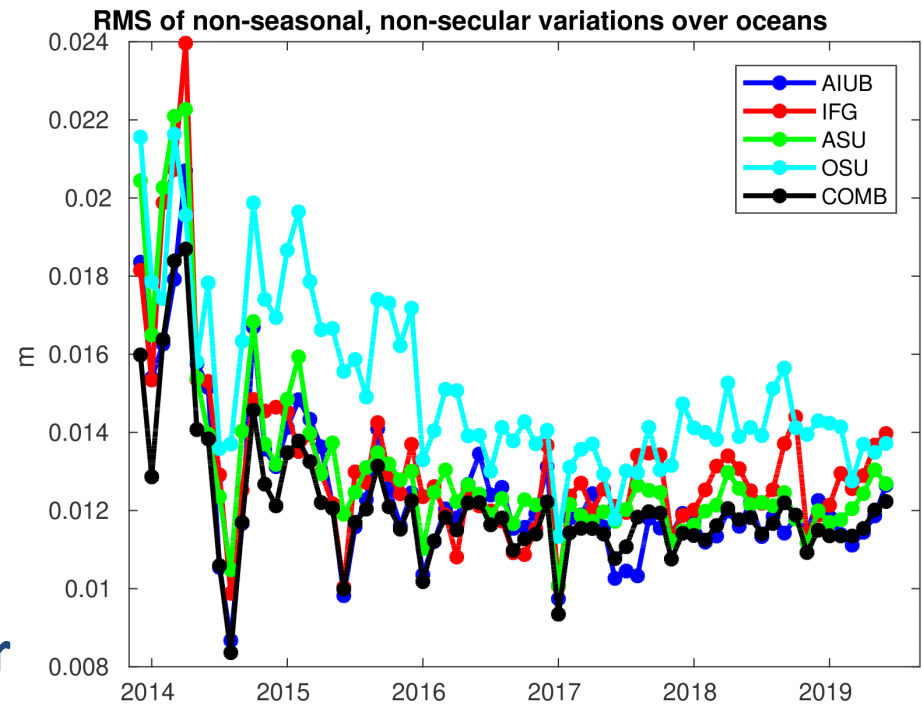


Noise Levels of Swarm Gravity Fields

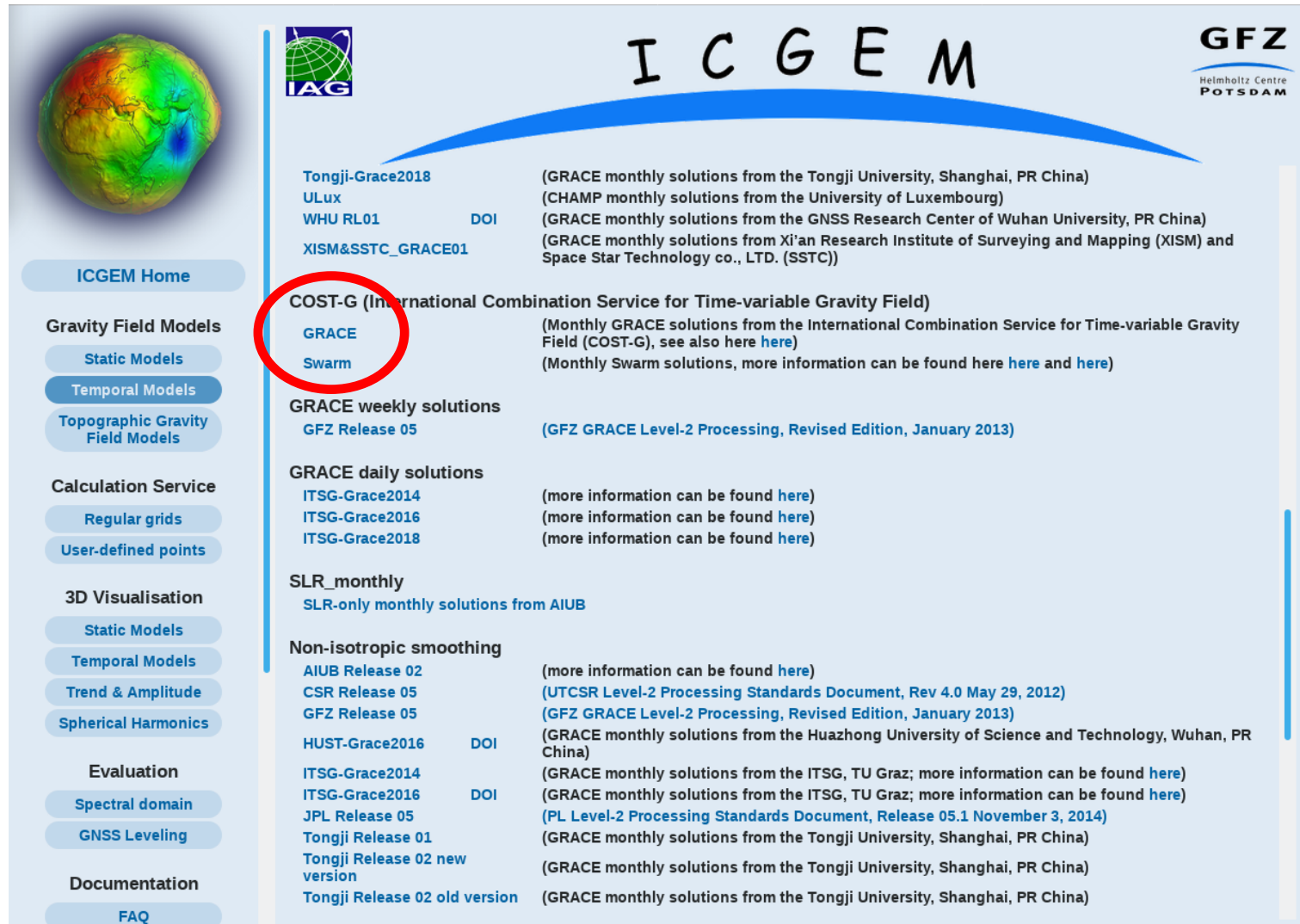


Smoothed by 400 km Gauss filter

Unfiltered



Product Dissemination



ICGEM

GFZ
Helmholtz Centre
POTSDAM

Tongji-Grace2018 (GRACE monthly solutions from the Tongji University, Shanghai, PR China)
ULux (CHAMP monthly solutions from the University of Luxembourg)
WHU RL01 DOI (GRACE monthly solutions from the GNSS Research Center of Wuhan University, PR China)
XISM&SSTC_GRACE01 (GRACE monthly solutions from Xi'an Research Institute of Surveying and Mapping (XISM) and Space Star Technology co., LTD. (SSTC))

COST-G (International Combination Service for Time-variable Gravity Field)
GRACE (Monthly GRACE solutions from the International Combination Service for Time-variable Gravity Field (COST-G), see also here [here](#))
Swarm (Monthly Swarm solutions, more information can be found here [here](#) and [here](#))

GRACE weekly solutions
GFZ Release 05 (GFZ GRACE Level-2 Processing, Revised Edition, January 2013)

GRACE daily solutions
ITSG-Grace2014 (more information can be found [here](#))
ITSG-Grace2016 (more information can be found [here](#))
ITSG-Grace2018 (more information can be found [here](#))

SLR_monthly
SLR-only monthly solutions from AIUB

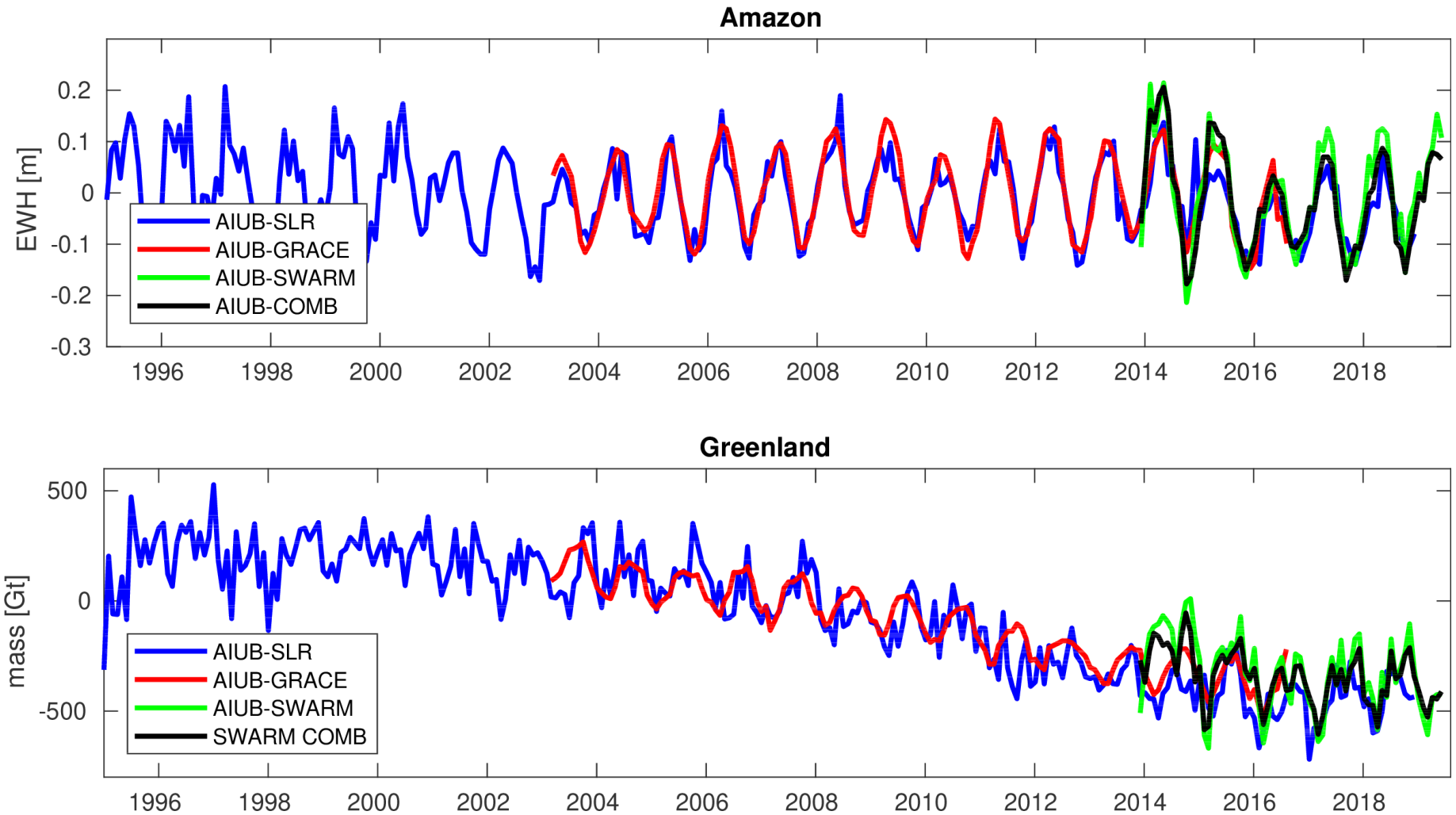
Non-isotropic smoothing
AIUB Release 02 (more information can be found [here](#))
CSR Release 05 (UTCSR Level-2 Processing Standards Document, Rev 4.0 May 29, 2012)
GFZ Release 05 (GFZ GRACE Level-2 Processing, Revised Edition, January 2013)
HUST-Grace2016 DOI (GRACE monthly solutions from the Huazhong University of Science and Technology, Wuhan, PR China)
ITSG-Grace2014 (GRACE monthly solutions from the ITSG, TU Graz; more information can be found [here](#))
ITSG-Grace2016 DOI (GRACE monthly solutions from the ITSG, TU Graz; more information can be found [here](#))
JPL Release 05 (PL Level-2 Processing Standards Document, Release 05.1 November 3, 2014)
Tongji Release 01 (GRACE monthly solutions from the Tongji University, Shanghai, PR China)
Tongji Release 02 new version (GRACE monthly solutions from the Tongji University, Shanghai, PR China)
Tongji Release 02 old version (GRACE monthly solutions from the Tongji University, Shanghai, PR China)



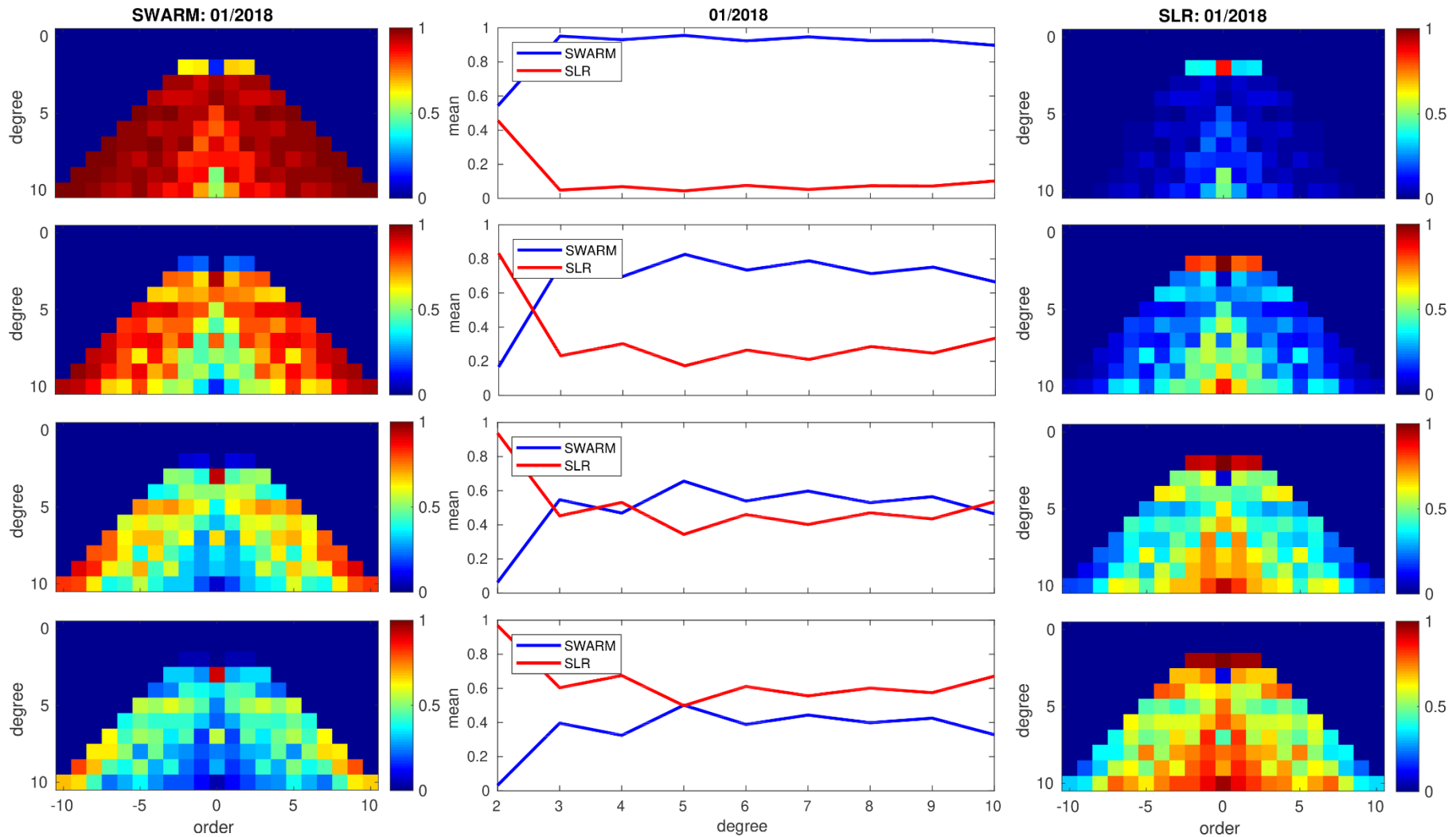
Swarm Data Quality Workshop

Prague, 16 – 20 September, 2019

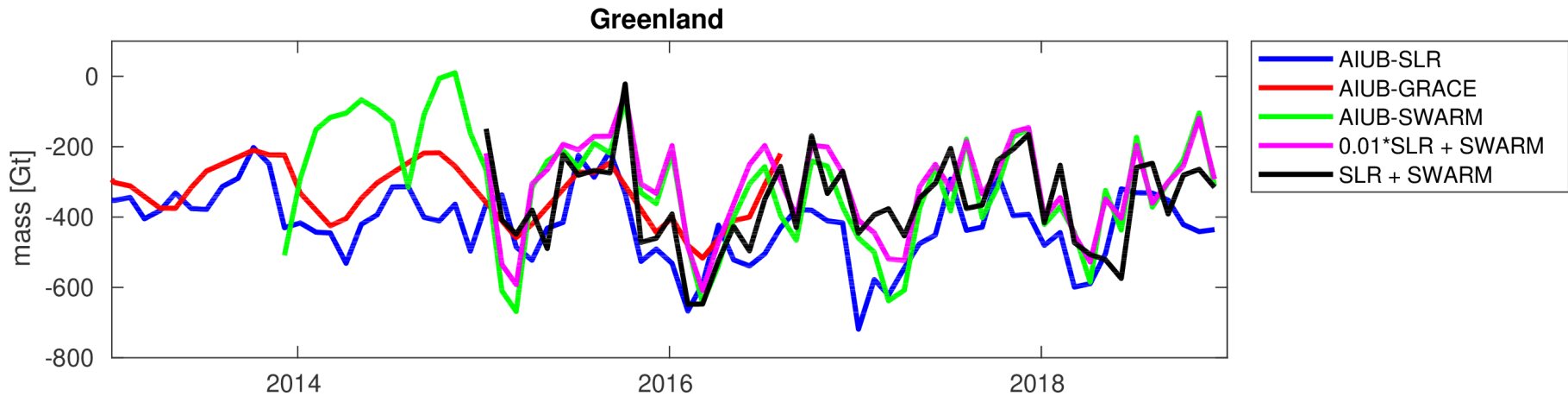
Application of Swarm Gravity Fields



Swarm / SLR Combination



Swarm / SLR Combination



Conclusions:

- Swarm monthly gravity fields are determined by several analysis centers (AIUB, ASU, IfG, OSU)
- Swarm gravity fields are combined by COST-G, the new product center of the IGFS (IAG)
- L2 products (spherical harmonic representation) are available at ICGEM
- Swarm gravity fields are useful, e.g., to bridge the gap between GRACE and GRACE-FO